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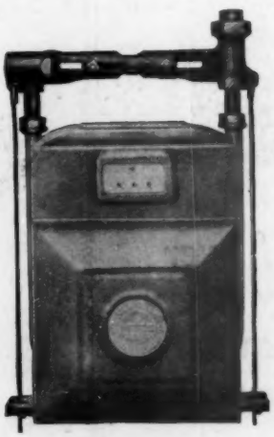

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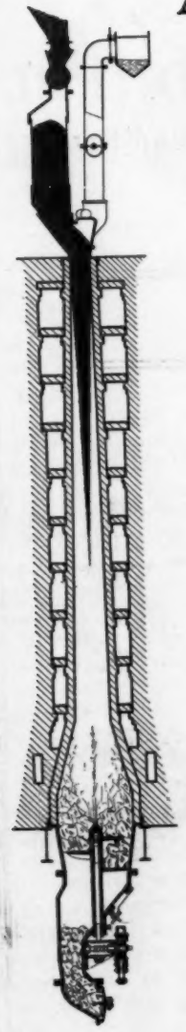

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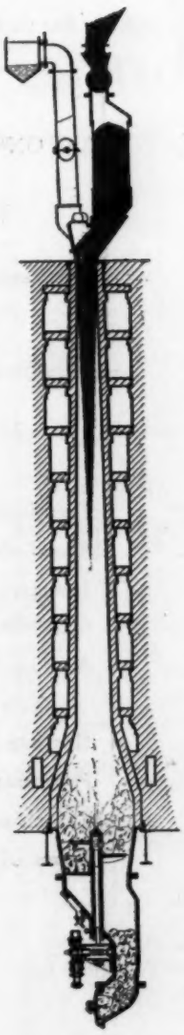

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AMERICAN
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Gas Industry In Best-Ever Condition

President of Eastern States Gas Conference outlines present and future status of gas

P. S. Young

Vice-President, Public Service Corporation of New Jersey

THE work of this organization has been directed in the past chiefly to the development and improvement of practical methods of operation in every department of the industry and particularly in connection with the work of the individual employee of gas companies. These conferences give the man in the field an opportunity to discuss matters which his work makes him familiar with.

This is highly desirable, as it stimulates interest and increases the effectiveness of the members. As the industry becomes larger, its problems become more diverse. It is desirable that not only should the managers of companies exchange ideas, but that the personnel generally should have an opportunity of doing the same.

Other Important Functions

There are other important ends which this organization can help to achieve. The gas industry is so closely interwoven with the economic life of the communities which it serves that it is important that gas companies should do everything possible to create underlying conditions of economic stability in their communities. They will thus help to foster a sound basis on which business enterprise may flourish and the communities which they serve prosper.

Public utilities are now taking their rightful place in the economic life of the nation. Public confidence in their policies, management and service is exemplified by the high credit they enjoy in the financal markets. The great demand for gas securities, and their high credit rating, is also an index of the general belief in the future economic usefulness of gas properties. The public recognizes the benefits derived by the public from this high credit position, which enables gas utilities to obtain the large sums of money required to serve the communities in which they operate without undue burden on the community.

Customer Ownership

One of the outstanding movements of the time has been the participation of the gas-consuming public in the ownership of gas properties—"Customer Ownership," as it is called. It is broader even than that, as in most cases where it is in operation it embraces employees as well as customers. The movement adds stability to the property affected and develops a community of interest between all concerned—the consuming public, the investor, the management and the personnel of the company. The result is a better understanding of the problems of the gas company and the creation of an underlying condition which promotes economy and efficiency of service. Customer ownership also has an important influence on the economic problem of the distribution of wealth and the development of thrift. It fosters the sterling qualities of self-reliance, industry and self-respect in the component members of the nation.

The early advocates of stock ownership by customers were perhaps not fully cognizant of how this plan squared with good business principles or of the tremendous potentiality of the movement they were inaugurating. But today it is fully recognized and the movement will not stop short of complete mutualization.

Regulation of Utilities

Not least among the factors contributive to the success of the movement has been the policy of governmental regulation of public utilities now generally in force. Regulation has been adopted by 42 states out of the 48, and in all territorial possessions,

as well as in the District of Columbia. In those states governmental authority stands sponsor for the facts relating to these enterprises. The customer-owner is thus kept informed through a properly constituted public authority of the soundness of the enterprise and the worth of the security he has invested in. Gas companies have come to realize that wide and even-handed regulation by properly constituted authority is a great improvement over regulation by agitation and that the public, representing the customer, and the company, representing the investor, must co-operate in every effort to promote proper economic development of the utility property if the greatest advantage to all concerned is to be secured.

Employees of gas companies are alive to the importance of cultivating the good will of the public by courteous attention to its needs at all times. They express in their work a fine spirit of service and the relations that result from contacts of this character are generally co-operative and truly beneficial in character. There is waste of effort whenever co-operation is unrecognized as a business policy in the conduct of a public utility.

High Standing of Public Utility Securities

Indication of the high standing of the securities of public utilities in the investment market is found in a recent report of the Life Insurance Presidents Association, which covers the activities of 41 companies, which report more than four-fifths of all the assets of life insurance companies in the country. The public utility bonds held by these companies total $405,000,000 and the holdings for all the companies are estimated at about $470,000,000. "Public utility bonds," says the report, "were the only securities held which increased both in value and in proportion to the total assets of the purchasing companies, and the increased investment in these utility securities has been a notable characteristic of recent life insurance financing. Many companies are now diverting a large proportion of their investment funds into securities of this class, in view of the safety and relatively high return upon such investments."

Responsibility is upon the management of the utility to build up an efficient engineering, operating, commercial and financial organization, as well as an economical and efficient physical plant. Gas companies must, by progressive activities, attract the enterprising and energetic worker and their managerial policies must be such as to open up avenues of advancement to their employees. Welfare measures of various kinds, while helpful, do not make up for lack of opportunity in attracting the best quality of employees.

Educational Work

Many gas companies are carrying on educational work through specially organized departments for the purpose of directing the studies of employees and stimulating the voluntary enrolment in study classes. The subjects discussed under class leaders all pertain to the business, and the object is to gain practical knowledge relating to the conduct of the gas business. Gas associations were among the earliest of business associations to organize systematic educational work and the results have been most beneficial to the industry. A broadening of this educational effort is necessary if the industry is to continue to attract a personnel of high caliber.

Gas companies have quite generally recognized their responsibility to their employees by making provision for sick benefits, insurance and pension systems. When properly applied, such provisions do not increase the cost of service, but promote efficient operation.

The gas industry has never been in so good a position as it now occupies. It has been converted from a lighting industry to a fuel industry with great advantage to itself and its customers. The enormous growth in the use of gas for domestic and industrial fuel purposes in the last few years marks a development that is almost revolutionary in domestic economy and industrial efficiency. In the six years ended with 1924 the sales of gas have been increased 33 1/3 per cent. The investment in the industry is estimated to be upwards of $3,000,000,000, and the number of consumers over 10,000,000.

(Continued on page 381)

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The Industrial Gas Survey *

Its importance, purpose and application in selling industrial gas

Henry O. Loebell

Vice-President and General Manager, Combustion Utilities Corporation

THERE are two principles which are fundamental in my present conception of the proper function of the artificial gas industry in the industrial world. These two principles are the foundation of the industrial survey as a necessary detail of procedure in the execution of that function.

The first principle is that the gas company should render a heating service to industry and should, therefore, advise industry how it can secure the heat it uses most economically, regardless of the fuel used. That may not sound to you as a proper basis for meeting competition with gas, but I am sufficiently confident of the fundamental soundness of gas as the ultimate fuel to proceed on that basis. I know from experience that where you do proceed in this way you establish a relation of confidence with industrial management which is otherwise impossible, and while you may not get immediately every installation you could sell, you will obtain far more installations which rightfully belong to you and in the end you will get them all.

Detailed Information on Costs and Methods

The second principle is that this heating service can be supplied only if the gas company has complete data on the utilization of fuel as a detail of production processes and can discuss that utilization in terms of cost of the finished product.

Method of Making the Survey

The procedure for this industrial survey for the gas company is, in general, as follows:

First—A general survey is made of the heating operations in the territory to determine those industries in which fuel is required in a refined state. While a complete survey of every industry is desirable eventually, the work can be planned so that those industries are considered first that offer the greatest opportunities for the sale of gas.

Second—Having determined a program as to industries, we next make a complete survey of every heating operation, conducting necessary tests and compiling all information that can be obtained which has a bearing on or is incident to the use of fuel and the fuel costs of production.

Analysis of Data

Third—This data is then analyzed by our engineering staff to determine the existing fuel costs per unit of finished product and economies which could be secured by better fuel utilization and combustion methods. These economies may be affected by any one or a combination of a number of factors such as change in fuel, more efficient fuel utilization, reduction in labor costs, reduction in spoilage, improved quality, increased capacities, etc. These factors involve anything from a simple furnace adjustment to a complete change in plant layout.

Fourth—A report is prepared for the gas company showing what load can be obtained with existing rates. It also classifies the remaining operations showing at what price levels for gas and competing fuels these operations can be converted to gas-fired equipment. This allows the gas company to determine the potential business of its territory so that it can, with a greater degree of certainty, budget its opportunity and forecast the growth of its load.

Complete Analysis of All Heating Operations

Fifth—Very often, where a complete survey is made of some particular industry, a report is presented to them giving complete analysis of every heating operation in their plant, recommending the fuels which should be used, at what price levels they should change from one fuel to another and best methods of utilization. This is important from your viewpoint, because it involves the decision regarding production policies as determined by fundamental fuel economies. The most serious step an industry can take from your viewpoint is definitely to commit itself to production processes and plant investment based on heating methods that are or will be fundamentally unsound within the life of the equipment. Incidentally, you may be interested to know that this plan is sound enough, that very often industries have been willing to pay the gas company the cost of such a survey.

An Example of a Survey

About a year ago a gas company 'phoned us an SOS that a plant in their territory, which I will term "plant A," because names in these illustrations are not important, was putting in a large plant extension and was about sold on electrical furnaces. After we had worked on this as an emergency proposition for about two weeks, we finally secured the order for gas-fired furnaces, which today are a revelation to this manufacturing concern. We all sat back completely winded with the satisfaction of having accomplished our immediate objective, but faced with the realization of two mistakes. First, we started off wrong, due to the short length of time allotted, by trying to sell gas when we should have been closing a heat treating detail of a complete

*Delivered at the 1925 Convention of the Eastern States Gas Conference, Newark, N. J.

scheme for the plant, and, second, and more important still in this case, we were looking on the installation as an objective when in reality it was only a good starting point.

Another plant, which I will call "plant B," seven or eight years ago installed three large patenting furnaces, ably assisted by the gas company officials. This installation has been consuming approximately 2,500,000 cubic feet per month of $1.25 gas and would appear to be an ideal installation. Recently they asked for bids on converting to oil. They had become so accustomed to the convenience of operation, cleanliness and quality of gas that this alone had lost its effect and their sole concern was price of fuels. The trouble was that these installations were sold without recording any information regarding the cost of other possible fuel substitutes or making any subsequent analysis. It is extremely important now that no time be lost in going back to that plant to analyze their complete problem and submit an engineering report which can and will hold that installation on gas.

Question of Cost

The third case, which I will call "plant C," is typical of a great many propositions that are submitted to us. In this case the gas company desires to convert some forging operations to gas-fired equipment. A forge was installed in this plant to operate on a comparative basis with their existing coal and oil-fired forges. It appeared after a short term of operation that the gas-fired forge was not meeting the fuel cost which had been stipulated by this plant as the cost of their coal and oil-fired operations. The difficulty was that, while they no doubt honestly believed that these costs as submitted by them were correct, we knew that they are far below the actual, but we had no way of making a proper analysis to prove it.

The Conclusions to Be Reached

Plant A installation shows how attacking small problems as complete in themselves instead of as a detail of the complete plant requirements prevented the gas company from working into that plant on the scale which is rightly theirs.

The desire of Plant B to change fuels without complete analysis points out that making a successful installation will not be permanent unless we prove to that manufacturer where those costs stand in relation to all other possible substitutes. This record should be taken at the time of the installation in his own figures, otherwise the fuel costs may apparently be creeping up when in reality his production may have greatly increased or other operations added which he is not taking into consideration.

The experience in Plant C demonstrates that the great majority of big industries cannot be induced to adopt gas merely by trial installations, but that the survey must necessarily go back and incorporate a more comprehensive study of their complete problems and accurate analysis of all features bearing on the subject.

Industry Survey Not an Experiment

The Industrial Survey is **not** an experiment to overcome such difficulties, but is a plan complete in every detail which has successfully met the requirements and solved the problem of supplying a proper and necessary foundation of information for sales work. The reason Surface Combustion has been able to swing complete steel mills over to our system is on the general basis of these principles. The fact that Chicago is supplying gas at the regular rates to ordinary brick kilns is on account of the application of these principles.

The Stewart Hartshorn Company, Newark, is a typical example of the soundness of this system of procedure. They have been using hot producer gas for the last 12 years and all of our men and the Public Service men considered hot producer gas such a cheap fuel that they were left strictly alone. Suddenly it was discovered that an electric furnace had been installed with electricity at 2 cents per KW, which on this operation would be, in terms of gas, a rate of $2.50 per M. With this slight indication that the price of fuel was not possibly paramount, we started after them. We submitted, at their request, over eight different proposals on various heat operations in their plant. A new problem arose in their minds with each proposal and they would request a different type. They could not make up their mind on any particular installation for the simple reason that the real problem concerned the entire plant. In desperation we finally sent over an engineer who was an expert on wire plants and made a complete survey of the plant, their existing operating costs were carefully investigated and tabulated, the construction of furnaces drawn up, costs of complete conversion and operation specified for city gas, oil, electricity and producer gas, and a complete report submitted guaranteeing our operating figures.

Results of Survey

Our survey showed that with artificial gas at 96.7 cents per M. we could save 50 per cent of their fuel costs. Ten days afterward the gas company had a request for service to supply 15,000 cubic feet of gas per hour. The work of establishing gas firing was undertaken gradually—first, the large baker in which the wire is dried after pickling was converted to gas. A change in the method of firing altogether with accurate control produced the same amount of work from one furnace that had formerly been obtained from two. Next a big patenting furnace was entirely rebuilt and designed especially for city gas. Due to the control of the proper temperature in the furnace, the savings in scale on this one furnace was sufficient to pay the entire city gas bill for the plant. In addition, the capacity of this furnace was doubled. The tempering unit was still operating on electricity.

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INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT — YOU CAN DO IT BETTER WITH GAS

Lesson No. 68

Heat and Change of State

How Far Is the Freezing Point Lowered

Perhaps the most important matter in connection with the lowering of the freezing point of liquids by dissolving salts in them is the calculation of the extent to which the freezing temperature is lowered. This can be done by the use of a simple formula, which is given below, for the case of aqueous solutions. In the following formula, w is the weight of the salt dissolved in 100 parts of water, while m is the molecular weight of the salt. The molecular weight of a substance (in this case a chemical substance is referred to, that is, one whose composition is known) is the sum of the atomic weights of the various elements that combine to form that substance. Thus salt is a chemical combination of sodium and chlorine. The atomic weights of sodium and chlorine are 23 and 35.5 respectively. Hence the molecular weight of salt is 23 plus 35.5, or 58.5, for the formula of salt is written NaCl, indicating that the molecule contains one atom of chlorine and one atom of sodium. A constant is used in the formula. This is 3.5 on an average.

Thus, the formula is written as follows:

Freezing point of an aqueous solution $= 32 - 3.5 \times \frac{w}{m}$.

Using the Formula

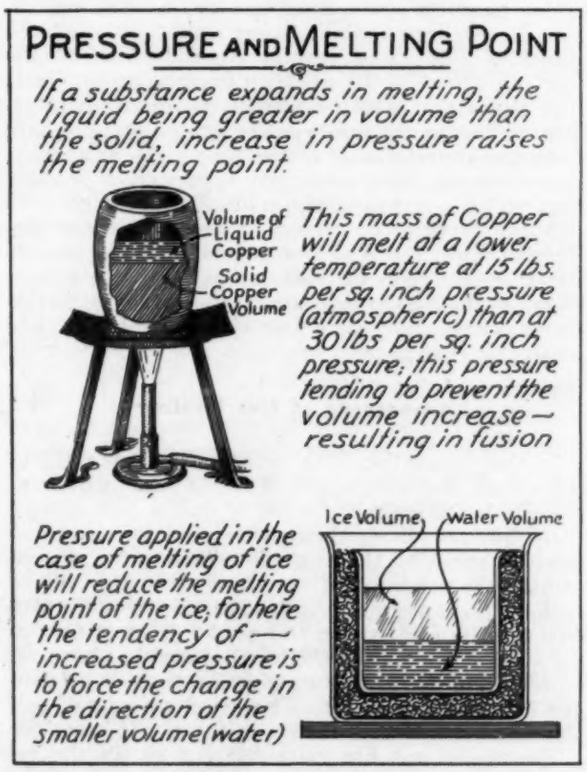
The freezing point of water is 32 degrees C. Suppose it was desired to find at what temperature a 10 per cent salt solution would freeze. In one hundred parts of the solvent there would be dissolved $10 \times \frac{100}{90}$ parts of salt, for a 10 per cent solution of salt indicates that there are present 10 parts of the salt to every 90 parts of water. Thus, w is equal to 11.1 and the molecular weight of the salt is 58.5. Substituting in the above equation we have as follows:

Freezing point of the solution $= 32 - 3.5 \times \frac{11.1}{58.5}$

or 29.69 degrees F. It must, of course, be mentioned that this is the freezing temperature of the salt solution under atmospheric pressure.

Pressure and Melting Point

It has already been mentioned that the application of pressure will lower the melting point of materials, like ice, which expand on solidification, while it will raise the melting point of a substance, like copper, which on melting increases in volume. Thus, in the first case it is easy to see that the application of pressure will tend to convert the solid ice into the liquid water, for the water will have a lesser volume than the ice and the tendency would be for the applied pressure to force the change in the direction of the liquid for this reason. Hence, the melting will take place at a lower temperature. In the case where a substance expands on melting, which is the case of copper, the application of pressure tends to keep the change from taking place and the melting of the steel will take place at a higher temperature than when pressure is not applied.


PRESSURE AND MELTING POINT
If a substance expands in melting, the liquid being greater in volume than the solid, increase in pressure raises the melting point.
Volume of Liquid Copper
Solid Copper Volume
This mass of Copper will melt at a lower temperature at 15 lbs. per sq. inch pressure (atmospheric) than at 30 lbs per sq. inch pressure; this pressure tending to prevent the volume increase — resulting in fusion
Pressure applied in the case of melting of ice will reduce the melting point of the ice; for here the tendency of — increased pressure is to force the change in the direction of the smaller volume (water)
Ice Volume
Water Volume

Gas for Space Heating

Controlling factors and importance of complete gasification

Dr. H. Strache

(At a recent meeting of the Eleventh Congress of Heating and Ventilation, held in Berlin, one of the principal topics which was discussed there was the use of gas in space heating. A very comprehensive paper was prepared by Dr. Strache, who is a German gas engineer of high reputation on this subject, and this was followed by a lengthy discussion. The entire matter is contained in Das Gas und Wasserfach, issue of February 14, 1925.

The translation that follows is merely a paraphrase of the aforementioned material. It contains interesting matter to the American gas man, for it shows what others have to say on that most important subject, the use of gas for space heating, the heating of houses and rooms with gas. It will be interesting to note that the arguments of the writer in favor of gas as a fuel for this purpose are entirely similar to those that are used in this country, while there are some that are new to us. —Trans.)

CONSIDERABLE attention is paid to the matter of pollution of air. Factories that throw out poisonous and deleterious fumes into the atmosphere have been made to dispose of their waste gases in some other fashion, so that vegetation is not destroyed or living conditions rendered difficult. The same careful consideration of the hygienic aspect of the situation must be paid to heating, although up to the present time but little attention has been given to it. Irregular heating, both from the consideration of the time element and the space element, is harmful, just as imperfect combustion with the resulting contamination of the air with unburnt particles of carbon in the form of smoke. Furthermore, there is the question of the loss of valuable by-products, such as tar, ammonia, sulphur, cyanogen, which are recoverable in usable forms when the coal is first changed into gas and when this is then used for room and house heating.

Advantages of Gas Heating

In this connection it is well to point out right at the outset the advantages that gas has to offer as a space heating agent.

In the first place, when gas is used for room and house heating, all the hygienic requirements as concerning the condition of the atmosphere are fulfilled in the highest degree. No coal dust or smoke is produced by its combustion and as the greatest part of the sulphur content of the original coal has been removed from the gas by purification there is no danger from sulphur gases. The small amount of sulphur compounds that remain in the gas is harmless.

The use of gas for space heating allows the recovery of all the valuable by-products that are recoverable from coal when it is destructively distilled.

Heating with gas is absolutely clean; it is free from dust and enhances the health and living conditions of those who inhabit the homes thus heated.

Gas heating allows most accurate regulation and is very rapid. Automatic means may be used to control the flow of gas and the temperature of the air in the room. Thus both insufficient heating at the start and overheating are avoided.

Gas Heating Economical

Gas heating is economical because it permits the heat to be turned off instantly when it is not wanted any longer.

When gas is used as a fuel for heating houses and rooms coal need not be bought and stored, and all the attendant troubles that arise from the use of coal are avoided.

The attention that has to be given to the heating apparatus is limited to lighting the gas fire, and in case there is no automatic temperature regulator employed then hand control of the flame is necessary.

The initial installation cost is small, comparatively speaking, although it is important not to spare expense in selecting a well-constructed heater in which the heating and radiating surfaces are properly proportioned.

Efficiency of Gas Heating

The efficiency obtained in gas heating is far superior to that obtained in coal heating. In complete gasification of coal, 80 per cent of the heat values in the coal may be obtained in the form of gas and when the properly constructed and dimensioned gas heater is used the efficiency of combustion and heat utilization is approximately 90 per cent, with the result that the overall efficiency is in the neighborhood of 72 per cent. This means that 72 per cent of the heat originally contained in the coal is put to useful purpose.

While there are certain disadvantages that are obtained in the use of gas for space heating, nevertheless, they are of such nature that they can all be avoided.

Dryness of the Air

One such disadvantage is the dryness of the air in the room. This supposed disadvantage is only a re-

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As The Journal Views It

THE INDUSTRIAL GAS SURVEY

In another part of the present issue is published a paper which describes in detail the industrial survey and its importance to any gas company that desires a permanent industrial load. This is a matter of singular importance and something which has perhaps not been sufficiently appreciated or understood by some industrial men and the executives of gas companies. It is something that requires expenditure reaching comparatively large figures, the justification of which is not always apparent to those who are asked to approve of them.

Those industrial gas men who have studied this matter, who have had experience with making industrial surveys and who know the results that have been obtained from them, understand what can be gained from this work. It is a fact that many gas company executives do not yet appreciate what must be done if their company is not only to secure industrial business, but to hold it as well.

It is true that much less attention has been paid by engineers and technologists, and practical men as well, to the development of scientific methods in the application of thermo processes, than is necessary in order to obtain efficient results. In many plants it will be found that, while the rest of the operations that are conducted therein are carefully controlled and carried out under conditions that have been developed in great detail, that while such scientific investigation has been thought advisable along these lines, practically nothing has been done of a similar nature to develop those parts of the manufacturing processes in which heat is employed. This is a condition that maintains in many industries and may be said to be due in large part to the cheapness of the fuel employed. There is, consequently, a false confidence existing in the executives' minds that the process is being carried out cheaply because of the low cost of the combustible.

Industry today is paying considerably more attention to its thermal operations than in the past. Plant managers and executives have awakened to the fact that the cost of fuel is not the only factor that must be considered, but that there are other costs which are far more important and which really make what seems a cheap process expensive.

An industrial survey has for its purpose the examination of the thermal operations which take place in a plant and the recommendation of changes therein that effect economies, not so much in the cost of the fuel as in the elimination of excessive labor, prevention of spoilage, augmenting of productive capacity of the installation, improving the quality of the product and the like. The information that is gained from an industrial survey of any one manufacturing process enables the gas man to prepare a comprehensive solution of the problem for presentation to the plant manager. This report involves all the operations that are carried out in the plant, and that make use of any sort of fuel. Such a prospectus is bound to be received with respect and attention and if the engineer is successful in selling gaseous fuel on such a basis he need not fear that the manufacturer will not remain sold indefinitely.

Haphazard selling of a prospect on gas for one individual operation can be productive of haphazard results only, and experience has taught that manufacturers who are sold in this manner do not remain sold. Sooner or later they change over to some other fuel which is presented to them in a more comprehensive manner and with the intent and purpose of solving all their thermal problems instead of just one.

There is no question but that an industrial survey involves expense and similarly that the benefit of such work and the justification of such expense are not immediately apparent. There is need for vision on the part of the gas company executive. He must look into the future. He must realize that if he can tell his industrial prospect all that has to be known regarding his thermal operations, that if he can solve them, not only by selling him gas, but by instituting improvements in the mechanical operations involved, such as transporting and handling the products that are being heat treated, but that if he

can show him how to effect economies which will far more counterbalance whatever extra cost is involved by the use of gas, then he will be constructing his industrial edifice on a firm foundation and secure for himself and his company a permanent industrial load.

Eastern States Gas Men Meet

Large attendance listens to comprehensive two-day program

THE 1925 convention of the Eastern States Gas Conference was held on Wednesday and Thursday, April 22-23, 1925, in the auditorium of the Public Service Electric and Gas Company in the Public Service Building in Newark, N. J.

The meeting was opened by P. S. Young, vice-president of the Public Service Corporation of New Jersey, president of the Eastern States Gas Conference, who introduced Uzah H. McCarter, president of the Fidelity-Union Trust Company. Mr. McCarter welcomed the gas men to Newark and complimented them on the large attendance.

President Young Addresses Convention

The convention then had the pleasure of listening to the address by the president, Mr. P. S. Young, vice-president of the Public Service Corporation of New Jersey. In his address Mr. Young discussed various factors in the public utility field today, such as the trend toward customer ownership, change in the manner of governmental regulation, the high standing of public utility bonds and stocks, etc. He also stated that one of the most important activities of gas companies has been in the education of their employees and said that a broadening of this educational effort is necessary if the industry is to continue to attract a personnel of high character.

He mentioned in his address that the position of the gas industry today has never been so good in its entire history and the future of the gas industry is assured as long as its leaders follow sound economical lines of development. The potent problem relating to the large investment required to serve the small consumer and the great number of unremunerative consumers was also touched upon. He indicated that partial solution can be found in the development of the use of gas for water heating.

He discussed the use of gas for industrial purposes and for space heating. In this conclusion he emphasized that the future of the gas industry depended upon the initiative, acumen and productiveness of the men and women who are devoting their business lives to its development.

Mr. H. C. Abell, president of the American Gas Association, was to have delivered an address, but sent his regrets, as he had been called out of town.

Major Forward Emphasizes Human Relations

Major Alexander Forward, secretary and manager of the American Gas Association, gave a very interesting talk in which he emphasized the importance of human relations in public utility work. He sketched the history of communication, from the old Roman roads to the modern railroads, and showed what an important effect this has had on the development of modern society as it is constituted today. He had something of interest and value to say about the relations between gas companies and other utility companies and public service commissioners. He stated that it is not the duty of a public service commissioner to institute any changes in rates, but it was up to the public utility to suggest the changes and have them passed upon by the commissioner. He emphasized the importance of the proper understanding of mutual problems and of the great value of co-operation in a get-together spirit between public officials and gas company officials.

Part of his address was taken up with the discussion of the great field that is presented to the gas industry at the present time and the opportunity that it has now in that supplies of oil are gradually being reduced. He had some very interesting figures to give on the consumption of oil in the country and stated that, according to the geologists, there is only a twelve-year supply on hand before the available oil resources are consumed if consumption is continued at the present rate. He stated that in 1921 there were available 588 barrels of crude for every automobile in the country, that in 1922 this had been reduced to 114, in 1923 to 47, and in 1924 it was reduced to 40 barrels.

He indicated that in the field of house heating the gas industry has another opportunity of revolutionizing the domestic life of the nation as well as it did when gas was introduced for cooking purposes. He mentioned the fact that there are now 10,000 gas-heated homes in America, that the Denver company has 500 installations, and that there are a similar number in New York City and that this is growing at the rate of 100 a year. Brooklyn, Philadelphia, Boston, Washington and other cities also report increases in this kind of business.

New Officers Elected

The nominating committee then reported the slate of officers for the next year, all of whom were unanimously elected, as follows: President, W. G. Gribbel, Philadelphia, Pa.; first vice-president, L. R. Dut-

(Continued on page 378)

PROGRESS IN GAS TECHNOLOGY
Domestic and Foreign

FACTORS INFLUENCING THE UTILITY OF SECONDARY AIR FOR COMBUSTION

THE amount of secondary air that is supplied to a gas flame affects the fraction thereof that is utilized for combustion, this fraction passing through a maximum with respect to the former. The experimental results show very clearly the inadvisability of attempting to remove the last traces of combustible from the stack gases, in view of the small rate of change, in this region, of utilized air with the total air supplied.

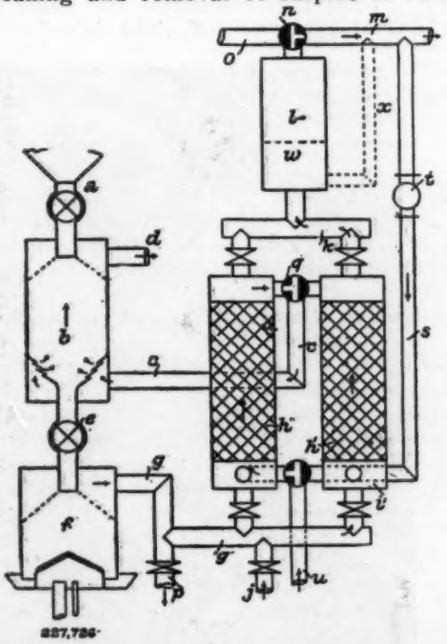
For any given amount of secondary air supplied to the flame the fraction that is utilized for combustion increases with both port velocity and diameter.

It is found that the variation of the air consumed in combustion with the log of the total air supplied can be represented, with good precision, by a straight line. This fact offers a convenient method for the extrapolation of two point data.—(Delivered at the Baltimore (1925) meeting of the A. C. S.)

COMPLETE GASIFICATION APPARATUS

IN the invention patented in British Patent No, 227,726, improved apparatus is provided for transmitting the heat from the blow gases or their combustion gases to the gas which serves as a heating fluid in the retort. Fuel is supplied through a valve a to a retort b, where it is internally heated by gas from regenerators h' or h", which enters through the pipe c. The gas and distillation products pass out through the pipe d to the cooling and cleaning plant. The coke passes downwards through a valve e to a producer f. During the blow period, the gas passes through the pipe g to one of the regenerators, e.g., h', where it is partly or wholly burned in the combustion chamber i' by air admitted through j. After heating the regenerator, the gas passes through a pipe k to a waste heat boiler l, and thence through a pipe m to the outlet.

The water gas produced may follow the route of the blow gas to the boiler l and thence through valve n and pipe o to the scrubber. Alternatively, the water gas may be immediately drawn off through the pipe p. Alternatively the water gas may be led directly into the retort b to heat it, or it may pass first through the regenerator and thence by valve q and pipe c to the retort b. In the two latter alternatives, the boiler l is heated only by the blow gas, and to compensate for this, a circuit of gas may be formed from the flue m through the pump t and pipe s to the regenerators. This flow of gas may be intermittent during the gas-making period, or continuous. A supplementary combustion chamber w may be provided for the blow gas. While the regenerator h' is being heated, gas for heating the retort b is passed through the pipe u and regenerator h" to the pipe c. If a rotary retort is employed, it may be combined with several producers, but only one pair of regenerators may be used. The water gas may be combined with the distillation gas, and after cleaning and removal of surplus is returned



through the pipe u. When the water gas passes straight to the regenerators for heating during gas-making periods, the auxiliary gas which effects this object during blow periods may consist of returned or circulating gas.

CONDENSERS

AN interesting paper on the design of condensers is published in the March 28 issue of the Gas World.

This paper discusses the advantages and disadvantages of atmospheric and water cooling and also the matter of heat transference in a condenser. Thus it was indicated that among the factors which complicate the heat transference in gas condensers are formation of scale on the water side of the tube, the fact that the gas is crude gas containing vapors and tar fog, and that a tar film forms on the gas side of the tube.

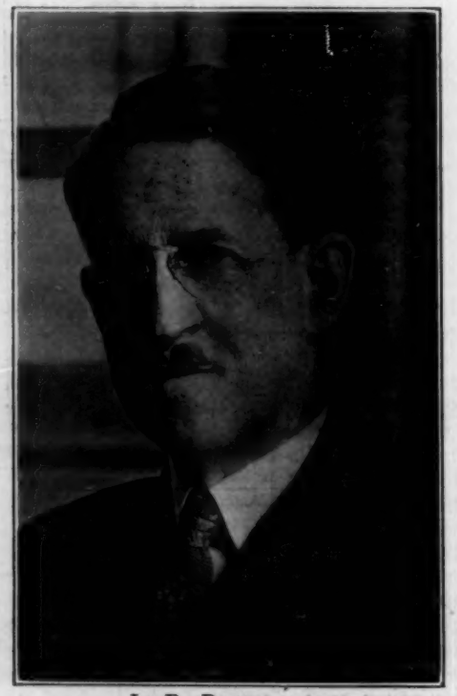
The advantages of increasing water velocity in a water-cooled condenser was said to be primarily increased transmission per unit of surface for a given temperature difference between water and the

gas. This difference may be utilized in different ways as, for example, by decreasing the size of the condenser plant or by decreasing the working temperature difference between the gas and water.

EASTERN STATES GAS MEN MEET AT NEWARK

(Continued from page 376)

ton, Jenkintown, Pa.; second vice-president, H. D. Whitcomb; third vice-president, J. B. Jones, Bridgeton, N. J.; secretary-treasurer, R. A. Koehler, Newark, N. J.; executive committee, two years, J. Meyer and H. Ganser; one year, Carlton Geist.



L. R. Dutton

National Sales Plan

The convention then had the pleasure of listening to Mr. J. B. Hanlan, chairman of the Commercial Section of the American Gas Association. He gave a detailed account of the National Sales program that had been developed by this section under the direct guidance of Mr. R. J. Canniff, chairman of the Sales Stimulation Committee. He brought out very clearly the great importance of this plan and the breadth of the work laid out. The project centers around a three-year sales program in the effort to increase gas sales by 50 per cent. The plan has been endorsed by the executive board of the American Gas Association, which has given its approval to the first year's program. He mentioned that, although national advertising is a very important work, nevertheless, the industry was not ready for it at the present time. Eventually this will have to be done. He described various details in the reorganization and importance of the monthly sales service issue, the monthly bulletins and the work being done to co-operate with architects and builders and to develop the text-books on the selling of gas for various purposes.

Discussion by Robert J. Canniff

Mr. Robert J. Canniff, chairman of the Sales Stimulation Committee, was asked to discuss the report, and in this discussion he said he thought a fundamental axiom that applied particularly to the selling of gas was, "If there is no vision, there can be no sales." He also discussed the importance of a movement taking place at the present time in large cities which is known as decentralization, which infers the moving away of the homes of people to outlying districts, from which they commute to the center of the city, where they do their business during the day and then return home at night. The importance of this movement to communities located around New York City, both in the State of New Jersey and the Hudson Valley, is very great and offers all sorts of opportunities to the gas utility which it should take advantage of.

Pennsylvania Gas Association Holds Annual Meeting

After the adjournment of the morning session of Wednesday, April 22, the annual meeting and luncheon of the Pennsylvania Gas Association was held in the Robert Treat Hotel in Newark, N. J. The officers of the association for the coming year who were elected at that meeting were as follows:

President, W. G. Murfit, Newtown, Pa.; first vice-president, R. C. Cornish, American Gas Association, Philadelphia, Pa.; second vice-president, J. A. Jeffrey, Scranton, Pa.; secretary-treasurer, G. S. Cullen.

At this meeting an important suggestion was made regarding the inauguration of an open house week some time in September or October, along the lines that had been carried out some time ago by the Michigan Utilities. The importance of this movement is evident to all who take time to consider it. For there is nothing so effective in promoting good will as personal contact, and the invitation to the public to visit the gas works and see what actually goes on in them is bound to have a favorable influence on the public. It is certain to convince them of the magnitude of the gas undertaking. There, in the gas works, they can see with their own eyes what it means to be supplied continuously at all hours of the day and night and at all times of the year with an adequate supply of gas.

Afternoon Session

The afternoon session was opened by a paper delivered by Thomas Matlick, engineer of the Public Service Electric & Gas Company, Plainfield, N. J., on the training of the personnel of the service department. In this paper Mr. Matlick described how

(Continued on page 386)

Catechism of Central Station Gas Engineering in the United States

Installment No. 68

(Continued from last week)

Weights of Products of Combustion

The weights of the products of combustion can be obtained from the answer to question No. 290 by multiplying the weights of the products per pound of combustible as given there by the weight of that volume of each substance which is shown by the analysis of the gas to enter into combustion. For the sake of avoiding an excessive number of decimal places in each multiplication, the calculation will be made on the basis of the combustion of 1,000 cubic feet of gas.

In each 1,000 cubic feet of the gas there will be:

27	cubic	feet	of	Carbon Dioxide.
7	"	"	"	Oxygen.
128	"	"	"	Olefiant Gas.
307	"	"	"	Carbon Monoxide.
324	"	"	"	Hydrogen.
139	"	"	"	Marsh Gas.
24	"	"	"	Ethane.
6	"	"	"	Benzene Vapor.
38	"	"	"	Nitrogen.

Weights of Constituents

The weight of each constituent per 1,000 cubic feet of the gas will therefore be (see answer to question No. 294):

Carbon Dioxide.....	$27 \times 0.11634 =$	3.141 lb.
Oxygen	$7 \times 0.08462 =$	0.592 lb.
Olefiant Gas	$128 \times 0.07404 =$	9.477 lb.
Carbon Monoxide....	$307 \times 0.07404 =$	22.730 lb.
Hydrogen	$324 \times 0.00529 =$	1.714 lb.
Marsh Gas.....	$139 \times 0.04231 =$	5.881 lb.
Ethane	$24 \times 0.07933 =$	1.904 lb.
Benzene Vapor.....	$6 \times 0.20625 =$	1.238 lb.
Nitrogen	$38 \times 0.07404 =$	2.814 lb.

The weights of the products of combustion of each constituent will be:

Constituents	Products CO_2	
Carbon Dioxide		3.141
Olefiant Gas	$3.14 \times 9.477 =$	29.758
Carbon Monoxide	$1.57 \times 22.730 =$	35.686
Marsh Gas	$2.75 \times 5.881 =$	16.173
Ethane	$2.94 \times 1.904 =$	5.598
Benzene Vapor	$3.39 \times 1.238 =$	4.197
		94.553

Constituents	Products H_2O	
Olefiant Gas	$1.29 \times 9.477 =$	12.225
Hydrogen	$9.00 \times 1.714 =$	15.426
Marsh Gas	$2.25 \times 5.881 =$	13.232
Ethane	$1.80 \times 1.904 =$	3.427
Benzene Vapor	$0.69 \times 1.238 =$	0.854
		45.164

Constituents	Products N_2	
Olefiant Gas	$11.35 \times 9.477 =$	107.564
Carbon Monoxide	$1.89 \times 22.730 =$	42.960
Hydrogen	$26.48 \times 1.714 =$	45.387
Marsh Gas	$13.24 \times 5.881 =$	77.864
Ethane	$12.38 \times 1.904 =$	23.572
Benzene Vapor	$10.19 \times 1.238 =$	12.615
Nitrogen		2,814
		312.776

Correction for Oxygen in Gas

Since the oxygen in the gas originally would aid in the combustion, there would be required so much less from the air, and therefore the weight of nitrogen would be reduced by the nitrogen associated in the air with 0.592 lb. of oxygen, or $0.592 \times 3.31 = 1.96$ lb., and the total products of combustion would be 94.553 lb. of carbon dioxide, 45.164 lb. of water vapor and 312.776 — 1.96 = 310.816 lb. of nitrogen.

The values at ordinary temperatures of the specific heats at constant pressure of the products of combustion are often used in determining the maximum flame temperatures that can be obtained, but this is not correct, because the specific heats of gases increase with the temperature. Therefore the use of the specific heats at ordinary temperatures makes the calculated temperatures too high, and the specific heats to be used in working out the problem should be taken from the table given in the answer to question No. 327.

Assuming a flame temperature of 3632 degrees, the specific heats as given in the tables will be.

Carbon Dioxide	0.368
Water Vapor	0.748
Nitrogen	0.327

and the theoretical rise in temperature produced by the combustion will equal,

$$\frac{569400}{94.553 \times 0.368 + 45.164 \times 0.748 + 310.816 \times 0.327} = \frac{569400}{34.80 + 33.78 + 101.64} = \frac{569400}{170.22} = 3345 \text{ deg. F.}$$

Adding 60 degrees to this the flame temperature would be 3405 degrees. The difference between the assumed and the calculated temperature is too great, so it is necessary to make another calculation.

Assuming 3452 degrees as the temperature the specific heats are found to be,

Carbon Dioxide	0.360
Water Vapor	0.732
Nitrogen	0.323

and the theoretical rise in temperature produced by the combustion will equal,

$$\frac{569400}{94.553\times0.360+45.164\times0.732+310.816\times0.323} =$$

$$\frac{569400}{34.04+33.06+100.39} = \frac{569400}{167.49} = 3399 \text{ deg. F.}$$

Adding 60 degrees to this the flame temperature would be 3459 degrees. This is practically the same as that assumed and can therefore be taken as the theoretical flame temperature of the gas named in the question.

This temperature can never be attained under actual conditions, since it is impossible to prevent losses of heat that result in keeping the temperature of the flame from reaching a theoretical height.

Mechanical Equivalent of Heat

332. What is meant by "The Mechanical Equivalent of Heat," and what is its value expressed in foot pounds per heat unit (British thermal unit)?

Ans. The "Mechanical Equivalent of Heat" is the amount of mechanical energy which is equivalent to (that is, which when transferred into heat will produce) one heat unit. (Century Dictionary.)

The first accurate determination of the value of this constant quantity was made in 1849 by Joule, who measured the amount of heat produced by the friction of a paddle wheel in a vessel of water, the energy required to turn the paddle being derived from the descent of a known weight through a known distance. He found that to raise the temperature of one pound of water 1 deg. F. required the expenditure of 772 foot pounds of mechanical work, viz.: the force resulting from the fall of one pound of matter through the space of 772 feet, or of 772 pounds of matter through one foot of space. Later investigations seem to indicate that a higher value (about 778 foot pounds) is more accurate, but nearly all the tables and all work done up to date are based upon the value of 772 foot pounds for the mechanical equivalent of one British thermal unit.

Vapor and Gas

333. What is a vapor? What is the difference between a true gas and a vapor?

Ans. Vapor, in physics, is the gaseous form which a solid or a liquid substance assumes when sufficiently heated. (Century Dictionary.)

As usually employed, vapor denotes the gaseous form of a substance which under ordinary conditions of pressure and temperature exists in a solid or liquid form. Thus, in common language, a difference is recognized between vapors and so-called true gases, since the latter are substances which exist normally in a gaseous state and can only be liquefied by being subjected to great pressure or intense cold, or both. There is, however, no real physical difference between these two classes of gaseous forms, as it has been found possible to liquefy all gases and thus bring them before liquefaction into a condition exactly the same as that of vapors at ordinary temperatures and pressures.

What is called a vapor is a substance in gaseous form near the point of saturation, that is, near the point at which any further increase of pressure or decrease of temperature will cause a portion of the substance to condense into the liquid or the solid state, while what is called a true gas is a substance in gaseous form, far removed from its point of saturation, and therefore capable of being compressed and cooled without the occurrence of any condensation.

The difference between a "vapor" and a "true gas" is thus merely comparative, being the same that exists to a lesser degree between saturated steam and superheated steam, and strictly speaking no known substance can be termed a true gas, since none with which we are acquainted is sufficiently removed from the point of saturation to obey perfectly the laws of expansion and contraction under changes of pressure and temperature that would apply to absolutely perfect gases according to the molecular theory of matter, though the gases which are farthest removed from the point of saturation, and therefore the hardest to liquefy, such as hydrogen, conform very closely to these laws.

Boiling Point of Water at Different Pressures

334. Give the temperature at which water boils when under pressures, as shown by a steam gauge, of 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 pounds per square inch respectively.

Ans. The temperature at which water boils under various pressures is as follows:

Gauge pressure					
10 lb.	= 24.7	lb.	absolute	pressure	239.38 deg. F.
20 "	= 34.7	"	"		258.71 deg. F.
30 "	= 44.7	"	"		273.93 deg. F.
40 "	= 54.7	"	"		286.61 deg. F.
50 "	= 64.7	"	"		297.52 deg. F.
60 "	= 74.7	"	"		307.17 deg. F.
70 "	= 84.7	"	"		315.83 deg. F.
80 "	= 94.7	"	"		323.71 deg. F.
90 "	= 104.7	"	"		330.96 deg. F.
100 "	= 114.7	"	"		337.68 deg. F.

(Sixty-ninth Installment Next Week)

GAS INDUSTRY IN BEST-EVER CONDITION

(Continued from page 370)

Future of Gas

The future of the gas business is assured just so long as its leaders follow sound economic lines of development. It is of prime importance that methods to reduce the investment costs of manufacturing and distributing plant capacity be constantly studied and applied, that economical processes of production and distribution be developed and introduced and that the market for gas for every purpose be intensively cultivated.

Recently President Coolidge has inspired the nation with renewed respect for the moral force which lies behind the exercise of economy. We must grasp its basic quality to understand how right he is in this emphasis. It is our responsibility to see that economy is applied in our daily task and in the operation of the properties for which we are all in a measure trustees. Economy is a positive force, not negative. It calls for intensity of effort on the part of the individual and wise expenditure of capital for productive purposes. Our effort in this direction must not be a mere gesture, but should embrace conscientious, careful and inspired planning for definite economies and efficient policies. Example in its practice is needed as well as precept.

Dire Effects of Inflation

Inflation has been abroad in the land and its effects must be grappled with in our industry as elsewhere if we hope to place it in the van of public utility enterprise. The dire effects of inflation in other countries than our own has served to warn us and there is little indication that we will be tempted by its false promises. Lasting prosperity can only be based on a sound political and financial structure and one which affords a guarantee for productive enterprise. To enjoy its full share in this prosperity each industry must contribute to the economic welfare of the whole body politic. I believe the gas industry is doing this.

One of the problems of the gas industry is the large investment required to serve the small consumer and the great number of unremunerative consumers due to the relatively small amount of gas used by such consumers in proportion to the investment required for their service. This is a practical problem and should be grappled with for the benefit of the whole body of consumers. A partial solution can be found in the development of the use of gas for water heating by such consumers.

Industrial Gas and Space Heating

The use of gas for fuel purposes in the industries has large possibilities. For this class of business demand and quantity rate, designed to encourage long hour use of capacity, are recommended, and with properly trained industrial fuel sales-engineers gas companies should be able to attract much additional business of this character.

Space heating with gas has been receiving much attention from gas companies. For comfort and convenience it is unsurpassed as a heating medium. There is in every community a potential market for gas for this purpose. These three avenues for the sale of gas are mentioned as presenting instances of the unpre-empted field of usefulness awaiting the industry's cultivation.

The industry is organized as never before. It has at its command the necessary funds from investors, confident in its soundness, to meet the enormous growth that is in sight. It enjoys the good opinion of the public, who comprise its customers, and its product is a necessity to the domestic and industrial life of the people.

Future of Industry Rests on Men In It

The future of the industry can be said, therefore, to depend principally upon the initiative, business acumen and productiveness of the men and women who are devoting their business lives to its development.

The committee in charge of the program has done its work well. It has prepared a program of subjects that are all of present interest and has not tried to cover too wide a field.

I hope that the members generally will take an active part in the discussion of these papers so that the most may be obtained from this conference.

THE INDUSTRIAL GAS SURVEY

(Continued from page 372)

The modern gas equipment and modern electric equipment operated side by side for the next six months. Based on this operating experience, the Stewart Hartshorn Company, of their own volition, asked us to convert the electric furnace to gas, even though they had already made high investments in this furnace.

Gas and the Product

How can we interpret gas in terms of the customers' product?

City gas cannot compete at the present time with any other fuels on a B.t.u. or price basis. The customers are not going to study out a means of changing their manufacturing methods to suit the fuel. There is only one solution, and that is the development of a means of utilizing that gas so efficiently in that particular plant in the realms of the other fuels and familiarizing ourselves so thoroughly with that manufacturer's products and methods that we can make up the difference still intervening by utilizing to the fullest extent the advantages inherent in gas to improve his methods of manufacture.

That, gentlemen, is absolutely the answer. It is the basis upon which we acquired the 20 billion cubic feet of gas load on our equipment, and our previous limitations in expanding our organization along these lines is the reason it is not 200 billion cubic feet.

Effect of the Survey

In brief, why does this method of procedure cause

a manufacturer to proceed with gas where a proposal for certain specific equipment or fuel fails?

First—Because it gives him confidence in the ability and judgment of those who are to render the service, such as the manufacturing and gas company.

Second—Because it gives him accurate information on every detail in which he is concerned in making his decision.

Third—Because its uniform simplified cost analysis enables him to keep constantly informed on the manufacturing costs and to eliminate many wastes.

Fourth—Because it shows him how his organization can be trained along specialized lines, practically eliminating irrelevant details of fuels and combustion.

Fifth—Because it provides a basis for modernizing all processes directly and indirectly connected with the heating operation, such as straight-line methods of handling work, automatic operation, accurate temperature controls, accurate reproduction of specified treatments, etc.

Sixth—Because it enables him to plan in a systematic fashion the development of his plant, prejudge their effects and arrange the financing on definite budget basis. Ford specifies such a report before allowing us even to bid.

Lack of Industrial Sales Plan

One of the messages I bring to you as a manufacturer is that the gas industry lacks a definite, well thought out, well organized sales plan for its product in the industrial field. We literally stumble onto propositions every day that apparently the gas company has never considered. Our open prospect sheet last week contained nearly 200 propositions on which we are in the various stages of apparently trying to induce the use of city gas. I could pick out for you 150 from this list which will slide gracefully off into oblivion without the slightest chance of closing, and yet every one of these are fine potential prospects for city gas.

There is just one reason why we cannot possibly close these orders and that is because we do not know and have not the facilities for finding out what they really need. This is no reflection on us all for not having gotten together on a basis of co-operation which would correct this condition.

Our objective coincides exactly with yours. We have the United States as a territory; you have your particular cities. No gas company, particularly those in the smaller cities, would be warranted in maintaining the force of specialists required for the large variety of single particular industries in their territory.

Industrial Survey and New Business Department

The industrial survey properly organized does not displace in any particular the function of your new business department—it is merely supplementary to their sales work. It gives them the engineering data upon which sales work can be carried out in an intelligent and therefore effective manner. This is as it should be, because experience has proven in many lines of activity that best results will be obtained if you have your salesmen stick to sales work and your engineers to engineering, instead of trying to consolidate both functions in one man.

We are inclined sometimes to sit back and rest on our sales problems with the hope that someone will place in our hands some new device that will allow us to secure a load which has previously been unobtainable. The hope of a device in the form of a new system of combustion or radical change in furnace design is ill founded. The only device I can suggest to you is the resolution in your own minds that you will tackle this problem as it is and not as you would like to have it.

If you do this you will inevitably use the industrial survey, because it is the only basis so far discovered upon which a sound and successful program for the sale of industrial gas can be developed.

GAS FOR SPACE HEATING

(Continued from page 374)

sult of over-heated radiation surfaces. At a temperature of 100 degrees C., which is also a temperature secured in steam heating, the dust that is present in the air sinks to the floor and has the effect of irritating the membranes of the breathing organs, with the result that it is said that the air is too dry in the room. It is a fact that the air which is heated with gas is no drier than the air that is heated in any other manner, as the winter air, which contains but little moisture, becomes relatively dry when it is heated to a higher temperature without the addition of water vapor in it. When the heating and the radiating surfaces are made proportionately large in the gas heaters, then the temperature will not rise above 80 degrees C. and the air is then not overheated and so the disagreeable effects of too dry air in the room are avoided.

Condensation of Water Vapor in Chimney

The condensation of water vapor in the chimney is a direct result of too great cooling of the flue gases coming from the gas-fired apparatus. Thus, when, in order to obtain the best possible utilization of the heat developed by the burning of the gas, the flue gases are cooled to such a point that condensation of the water vapor takes place, the one effective way to get around this trouble is to allow the flue gases to enter the chimney at a higher temperature. The addition of cold air is not always the cure for this trouble, but often acts in entirely the opposite manner and enhances the formation of condensates.

Danger of explosion or the emission of unburnt gases into the atmosphere is possible only in heaters which are not properly constructed. There are various details of the construction of the heaters that, when carried out, prevent all danger of explosion and the incomplete combustion of the gas-air mixtures.

As far as the chance of explosion of the gas-air mixture in the apparatus itself is concerned, there need be no fear that this will give bad results, for such explosions are trivial and the open chimney gives every opportunity for the increase in gaseous

volume to be dissipated without doing any harm. But they can be entirely prevented by designing the burners in such a manner that no unburnt gas can penetrate into the interior of the gas appliance.

The Cost of the Installation

The cost of operating the gas-heating appliance depends on the price of the gas and on the efficiency of the appliance itself. Inasmuch as the efficiency of the well-designed gas heater is great, the fundamental factor is the cost of the gas per 1,000 cubic feet. This cost may also be figured on the thermal unit basis. It is interesting to note that in many parts of Germany the price of gas is so low that it can compete very well with other fuels for space and house heating.

Badly designed gas appliances are always a detriment to the gas industry of any country and it is a happy condition that such apparatus is seldom found on the market anywhere. In order for the apparatus to give good results the following principles must be followed out in its design. .

Complete Combustion

No products of incomplete combustion, such as carbon monoxide, methane, soot, unsaturated hydrocarbons of a vile odor, must be produced by the apparatus. The flame must not come in contact with metallic parts and cold portions of the heater, for when this takes place there is always danger that incomplete combustion of the gas will ensue. The individual flames in the burner must not be located too close together, so that there is no question but that every flame receives a sufficient amount of air to ensure complete combustion of the gas. The flue gases or gases of combustion must not be permitted to mix with the fresh air. Then, again, the apparatus must be constructed in such a manner that when the burner is lighted on one side the flame travels around to all the jets very rapidly and, moreover, when the flames are accidentally extinguished, the gas issuing forth from the jet will be ignited again automatically.

Then, again, in order to obtain the highest efficiency in the utilization of the gaseous fuel, it is essential that the air is not added in great excess. When the gas used is made by the distillation of coal or by the decomposition of carbonaceous fuel with steam or is a mixture of coal and water gas, then the carbon dioxide content of the gases of combustion should be between 5 to 8 per cent. Such a condition can be secured only when the air is led directly to the individual flames and no excess air is allowed to come in contact with the burning gas.

Consumption of Gas

The consumption of gas at average pressure must be determined with consideration of the size of the heating surface and this figure must be fixed at such a point that the temperature of the flue gases is reduced to 150 degrees C. However, long pipes leading from the heater to the chimney should be avoided, for it is possible that the water vapor in these gases will be cooled down to the condensation point when such an arrangement is employed. A thermal efficiency of 90 per cent can be obtained when the carbon dioxide content of the waste gases is 6 per cent and the temperature of these gases is 150 degrees C. The cooling of the flue gases below their dew point is only admissible when the condensed water can be led away in some suitable manner and the waste gases thereafter heated up again.

Avoiding Flare Back

In order to avoid a flare back of the waste gases caused by currents of air and the extinguishing of some of the flames of burning gas at times and at the same time in order to render the operation of the furnace completely independent of the natural draft afforded by the chimney, it is customary to install a damper or interrupting device in the flue gas pipe. Arrangements which provide for the removal of the flue gases which are sucked back into the apparatus at some point in the neighborhood of the flame are not as effective, as it often happens that when these devices are employed the flue gases are allowed to filter into the room. Then, again, the addition of air to the burning flame is not as accurately controlled.

Furthermore, the apparatus must be constructed in such a manner that the gases of combustion and the unburnt gas as well, in cases where the flames or parts of them do not burn, must be prevented from entering the room in which the heater is placed.

Heating Surfaces

The heating surfaces in the heaters must be dimensioned in such a manner that they are sufficiently large for the purpose. About one square meter must be provided for every 2,000 calories required. The heating surfaces must also be placed in a vertical position as far as possible. Furthermore, they must be smooth and easily removable and replaced. This is necessary in order to avoid the accumulation of dust and at the same time the circulation of air through the apparatus must be as vigorous as possible in order that the heat in the heating or radiating surfaces is carried away as rapidly as possible. This, then, means that the passage for the entrance and conduction of the air through the apparatus must be as large as possible, as in this way large circulation of air is possible and the temperature of this air is accordingly low and the danger of scorching the dust that collects in the apparatus is less. However, when the circulation of the air is rapid, then the coefficient of heat transmission is higher and consequently the temperature of the air is less.

Further Points to Be Looked Out For

It is always better to sell space heaters, not on the basis of the size of the room which they are expected to heat, but on the area of the radiating surface which they contain.

If fresh air channels for the admission of air used in combustion or for circulation are provided in the apparatus, then the openings of these channels should be placed as far as possible in such positions that make the same angle with the vertical as the outlet of the flue gas tube, as in this manner the effect of air currents is avoided.

Heating surfaces which are made of wrought iron heat up more quickly, and therefore, when heated, they yield less water of condensation. On the other hand, heating surfaces which are made of cast iron are considerably more lasting.

The pipe which feeds the gas into the apparatus must be made in sufficient size so that the proper amount of gas is allowed to enter the heating apparatus.

An automatic temperature regulator is always useful in that it prevents the overheating of the room and also tends to maintain a uniform room temperature.

Basic Character of Design

There are two general principles that are involved in the heating of a room and that are followed out in the construction of room heaters. The first method of heating depends on the heating of the air by radiation and the second by heating through convection. Although the results that are obtained in both cases are exactly the same, nevertheless, the manner of the heat distribution is different.

Radiation of heat results in the heating of objects that are found in the room on the side that faces the heater and the temperature of these objects reduces as their distance increases from the heater. The temperature distribution is accordingly irregular. The intensity of the radiation is dependent very largely on the degree of temperature, as radiation increases as the fourth power of the absolute temperature. Thus, it follows that if it is desired to heat by means of radiation alone, it is necessary to have very high temperatures or else very large radiating surfaces. The flame temperature must, therefore, be very high under these conditions and then, again, the radiation of heat from the flame is increased by placing various refractory radiating surfaces in the flame itself. The use of large heating surfaces at low temperatures is not carried out to any great extent at all in the construction of gas heaters, but this is a field in which much progress can be made.

The radiation of heat results in the transference of a greater quantity of calories than by the circulation of air, with the result that those bodies that come into contact with the radiated heat become warmer than the surrounding air.

On the other hand, it is a fact that the room that is heated by air circulation, that is, by convection of heat, is more uniformly heated, but inasmuch as the air is the heat carrier the former is warmer than the bodies that are to be heated. This results in a sultry feeling in people who remain in the room for any length of time. Furthermore, the upper layers of air become hotter than the lower, which is a distinct disadvantage, for it is evident that it is only by very vigorous circulation that it is possible to maintain a uniform temperature throughout.

Heating by Combined Convection and Radiation

Ordinarily heating takes place through the combined action of convection and radiation. From a practical standpoint it is impossible to cut out either one or the other form of heat transmission in its entirety. But it is a fact that one or the other method of heat transmission is emphasized in the heating process of a particular design of gas heater and it is possible to classify them accordingly. (The author at this point describes the salient features of various designs of heaters used in Europe, which does not interest us to any degree.—Edit.)

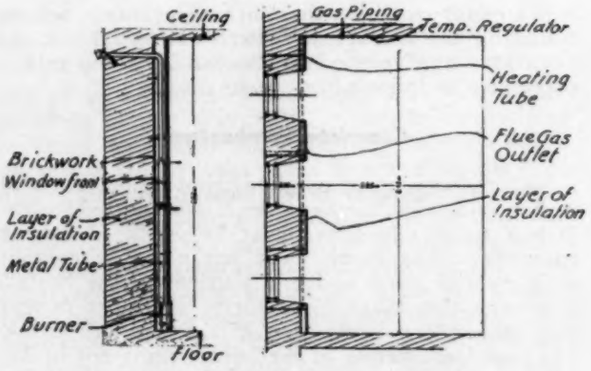


Fig. 1. Radiation-Compensation System

A particular form of heating which was developed by the writer and which is not generally known consists not so much in the heating of the room itself, as it is ordinarily carried out, but is rather a means of preventing radiation of heat from the room through the walls of the building. This heating system is seen in the accompanying figure. (See Fig. 1.)

Description of Installation

A lath is built around the walls of a room, as shown in the figure. This partition, which it really is, cuts off an air space, which is only a few centimeters wide, from the rest of the room. No provision is made for air circulation from this partitioned portion to the rest of the room which is to be heated. Now, then, when this small space is heated in any suitable manner, by means of gas, for example, as is shown in the illustration, it is evident that the transmission of heat through the walls of the building will be stopped as far as the heat in the room itself is concerned. The contention, then, is that if once the temperature of the room is brought to the proper point, say 65 to 70 degrees F., this temperature will be indefinitely maintained within the room as long as the partitioned air space

is heated. The figures show how the gases of combustion that are formed by the burning of the gas are led away through a pipe which opens out in the open air. (Whether this arrangement is practical or not, and it is questionable if it is, it is an interesting application of a law of heat to the maintenance of constant room temperature. One great drawback is that the window space in the house cannot be provided with such a heating arrangement and the loss of heat through the windows is considerable. The author proposes to get around the difficulty of maintaining the temperature within the enclosed space some degrees higher than the temperature of the room in order to compensate for the heat lost through the windows.—Editor.)

Actual tests have been carried out with this mode of heating and the results are claimed to have been successful. The author also takes up the question of steam and hot water heating of houses by means of gas and is of the opinion that it is only a matter of the cost of the gas that delays further development along these lines. The controlling factor is the method of gasification employed in the gas works and it is hoped to improve the manufacturing process so that cheaper gas can be secured.

Yellow or Blue Flame in Heaters

Some types of gas heaters work with a yellow flame and others with a blue flame. Of course, the blue flame always possesses the danger that it may flare back, but then, again, this is very successfully prevented in well-designed heaters. When using gas which does not contain much illuminants, as is the case with gas almost everywhere today, on account of its lessened use as a lighting medium, it is unnecessary to use blue burners, for when the gas is burnt in a number of small flames the luminosity is removed from the flame without the admixture of air with it. However, when this is done, it is necessary to use burners that are provided with very small openings, and the danger then is that these openings will become stopped up by the impurities that are contained in gas in small quantities. It is possible to avoid this difficulty by using special designs of burners.

Temperature Regulation

The use of automatic temperature regulators is important. It is advisable to use this apparatus in such a manner that the temperature of the room and not of the heater is controlled. There are various sorts of such temperature regulators.

The nature of the gas that is used in the heating apparatus determines to a large degree the economy of the heating process. Thus, while coal gas was made first and is still used alone in certain cases, its mixture with water gas to give a mixed gas has been of favorable influence on the use of gas for space heating, for the reason that the cost of the mixed gas is lower. The use of producer gas is also gone into and mention is made of the important development of complete gasification. The gas that is made from oil and tar is also employed to some extent in heating rooms, and in this case the burner must be specially designed in order to give good results.

Future of Space Heating

In studying this subject the future of house heating and room heating by gas is of interest. The question arises along which lines must progress be made in the gas industry in order to increase the use of gas for these purposes. There are two ways which lie open to the gas industry. In the first place there is the question of the manufacture of the gas by the coking of the coal and in the use of the gas in the kitchen for heating water, and for industrial purposes, and the use of the coke for house heating. The other way lies in the complete gasification of the coal whereby it is possible to manufacture five times as much gas from the coal, but without the recovery of coke or other by-products. This process must, however, be able to reduce the price of gas to such an extent that it will be suitable for all purposes.

At the present time most gas works are operated along the first lines. They still use the retort ovens and they hold to the opinion that a great house heating load is not in the interest of the gas company, for the reason that the gas plant will be hard put to it to fill the demands for gas on a cold winter day.

Complete Gasification of Coal

The complete gasification of coal is carried out in apparatus which cannot be hurt by variation in the demand for gas. These gas generators, which can be made ready for operation within a half hour's time, are therefore suitable for this intermittent kind of operation. For the same reason it is not necessary to have such large holders in plants that use the complete gasification system.

The argument that is brought up against the use of the complete gasification process is that it will bring down the thermal value of the gas, which is not in the interest of the consumer. But if the customer pays for gas on the thermal basis, as is done in England, then this will make no difference to him. The idea that when the gas that is distributed possesses a low thermal value the cost of distribution increases, when large quantities of such gas are delivered, is incorrect. The cost of the piping systems does not become greater with greater gas sales per 1,000 calories and per kilometer length, but they actually become less as the per meter consumption becomes greater.

Conclusion

Thus, in investigating the question of the use of gas for room heating, no individual condition must be given too much importance, but all conditions must be taken into consideration as a whole. Those that affect the solution of this problem may be summarized as follows:

1. Complete gasification of the coal in generators

with an efficiency of 80 per cent, with small holder capacity and large reserve of generators.

2. Gas burners of 90 per cent efficiency should be constructed so that gas heating is conducted along the most economical lines.

3. The reduction of the calorific power of the gas to 3,200 calories per cubic meter, brought about by the complete gasification process, results in a considerable reduction in the price of the gaseous fuel, so that when the gas is employed with an efficiency of 90 per cent in the space heater the costs will not be higher than what are incurred in its use in the continuous heating furnace.

4. Then, again, the consumption of gas is increased because of the lowering in the price of the fuel, with the result that the distribution costs are reduced as well.

EASTERN STATES GAS MEN MEET AT NEWARK

(Continued from page 378)

these men are trained and discussed the importance of having a well-knit and closely co-operating organization, something that can be secured only by properly educating and training the men.

This was followed by a talk on "Accident Prevention," by C. B. Scott, Bureau of Safety, Chicago, Ill. The next item on the program was the presentation of the McCarter medals by Dudley Farrand, vice-president of the Public Service Gas & Electric Company.

The next paper was a very interesting discussion of "How to Make the Gas Works Attractive," by Mr. J. B. Jones, president of the Bridgeton Gas Light Company, Bridgeton, N. J. This was followed by a talk on the Waterless Gas Holder, by A. S. Miller, vice-president of the Bartlett-Hayward Company, Baltimore, Md. The talk was illustrated with lantern slides.

All papers were followed by interesting discussions, and after Mr. Miller's paper the meeting adjourned until 10 a. m. Thursday.

In the evening there was a moving picture presented entitled "Newark and Public Service," and after that there was a well-attended and much-enjoyed dance.

Thursday Session

The first paper in the Thursday morning session was delivered by Mr. J. L. Conover, auditor of the Gas Department, Public Service Gas & Electric Company, Newark, N. J. Mr. Conover's subject was "Mechanical Billing of Customers' Accounts." This paper was followed by a very interesting talk by J. A. Berry, United Gas Improvement Company, Philadelphia, Pa., on "The Future of House Heating by Gas." The last paper of the morning session was delivered by Percy H. Whiting, of the Henry L. Doherty & Co., New York City, on "Secrets of Success in Selling Securities to Customers." In this paper Mr. Whiting aptly remarked that the only excuse a company can have for not seeking customer-ownership is that it needs neither capital nor friends. Mr. Whiting emphasized the importance of the advertising campaign in this connection and said that short, sharp campaigns were better than long or perpetual campaigns.

New Jersey Association Holds Annual Meeting

After the adjournment of the morning session the annual meeting of the New Jersey Gas Association was held. At this meeting the officers who were elected for next year were as follows:

President, H. D. Whitcomb; first vice-president, L. N. Yetter; second vice-president, J. L. Conover; secretary and treasurer, R. A. Kohler; directors for period of two years, H. A. Stockton, R. J. Ritchie and R. R. Young; for period of one year, to fill the unexpired term of Mr. J. L. Conover, Jessie R. Stetser; ex-officio director for one year, Raymond W. Lee.

Importance of Industrial Survey

The opening paper of the afternoon meeting was by H. O. Lobell, president Surface Combustion, New York City, on the "Importance of Industrial Survey." In this paper Mr. Lobell went into considerable detail to explain what is meant by the Industrial Survey and how such surveys make possible permanent sales of gas for industrial purposes.

The next talk was delivered by Wayne W. Calhoun, who had some very interesting remarks to make on the subject of "Selling More Gas Appliances with the Aid of a Manufacturer." He outlined in general the nature of the co-operation that must exist between the manufacturer and the gas company in order for the former to be able to sell more gas appliances, consequently more gas. He mentioned that the manufacturers should be ready to aid the gas companies if they are called upon to build up their sales organizations.

The convention then had the great pleasure of listening to the paper of Miss Janet MacRorie, editor of Advertising, on the subject of selling. Miss MacRorie stated that there has been found no better medium of reaching the people than by the newspaper. She brought out the fact that when such advertising is undertaken by the gas company it must be continuous in its stimulation, must be constantly changed, freshened and improved.

The meeting was brought to a close by a paper by Miss A. B. Swan, of Home Service Company, on "Home Service Work and Its Effect on Public Relations."

The annual banquet was held in the ball room of the Robert Treat Hotel, Thursday night at 6:30. Following the banquet there was dancing.

NEWS OF THE GAS INDUSTRY

Iowa Gas Men Meet

Annual Meeting at Cedar Rapids Largely Attended

The Iowa District Gas Association, comprising gas companies in Iowa, Minnesota, Nebraska and North and South Dakota, met at Cedar Rapids, Iowa, April 22-24, with a registration of about 300 members.

The morning of April 22 was devoted to a meeting of the council of the association and nominating committee. The council acted on applications for membership and outlined plans for the convention.

Officers for Next Year

The report of the nominating committee was adopted at the opening session of the convention in the afternoon. Officers elected were as follows:

President—C. M. Benedict, Des Moines, president of the Des Moines Gas Company.

First vice-president—F. S. Edge, Grinnell, general manager Peoples Light & Fuel Company.

Second vice-president—C. A. Nash, Davenport, sales manager, the United Light & Power Company.

Secretary—H. M. Sterrett, Des Moines, general manager, the Des Moines Gas Company.

Reports of various officers and committees were read at the afternoon session.

Report on Fourth Meter Course

C. R. Stahl of Davenport gave an interesting report on the work which the engineering extension department of Ames College is doing to improve the knowledge of gas men concerning gas meters. The college conducts a short course for metermen each year. Factory experts and skilled mechanicians from the biggest gas companies in the country are in charge. Men from the meter departments of the various companies attend this school and receive instruction in the care and regulation of meters.

The gas meter is a delicate instrument, but its degree of accuracy has been so improved that it is more dependable than the best made watches. These courses of instruction are calculated to keep up such standard.

Joe Carmichael Reports on Utility Information Work

That the Iowa gas companies, electric light and power companies and electric railways, have given other industries and communities a splendid example of how the wheels of progress can be accelerated by the removal of friction, was claimed by Joe Carmichael, director of the Iowa Committee on Public Utility Information.

C. M. Benedict

"These utility companies during the past few years, by making a constant effort to inform the public about their organization, their operation and the problems they face, have placed themselves in a position where they now have the confidence and the co-operation of the public. They are no longer obliged to spend a great part of their time and immense sums of money defending themselves from malicious attacks.

"These utilities must expand rapidly to take care of the constantly growing needs for their service. They must expand in advance of other industry.

"Such expansion is retarded by misunderstanding, unwarranted attacks and suspicion.

"These companies have adopted a definite, consistent program of publicity, the greater part of which is conducted through the advertising columns of the newspapers.

"They are making an effort to give good service at reasonable rates and then constantly keep telling the public about it."

President Carson Addresses Meeting

"The gas industry is in the beginning of its period of greatest development," H. J. Carson of

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West Gas Improvement Company Moving Offices Uptown

In line with the present trend of New York engineering firms to establish their offices in the easily accessible Grand Central district, the West Gas Improvement Company of America will move, on May 1, from their present offices at 150 Nassau street to 441 Lexington avenue, at 44th street, near Grand Central Terminal.

This move will allow the West Gas Improvement Company added facilities in their business as gas engineers and contractors for complete installations of Glover-West Vertical Retorts.

The total daily capacity of Glover-West Vertical Retorts installed or on order in North and South America is now thirty-six million cubic feet, of which five plants comprising thirteen million cubic feet capacity are at present under construction.

Cedar Rapids, president of the Iowa District Gas Association, declared in his address to the convention.

"The household use of gas has increased 100 per cent in the last ten years," he said, "and the use of gas in industry has increased 1,000 per cent.

"There is a keen interest throughout the industry in improved methods of manufacture and distribution and the rendering of obliging and complete service to customers. One engineer recently remarked that more men are now engaged in looking at water gas sets upside down, sideways and in every other way, in an effort to effect further economies, and that it would be strange if decided improvements are not forthcoming within a few years.

"Advances have been made in the manufacture of gas ranges, water heaters and other domestic appliances, with a decided gain in attractiveness, durability, convenience and efficiency. The manufacturers of industrial equipment have done much to further the industrial use of gas furnaces and equipment, for many processes have become standardized with reduced first cost as well as low operating costs.

"Much progress has been made in gas house heating during the past year. There is much in its favor, as it eliminates smoke in residence neighborhoods, dust and ashes in the home and provides uniform temperatures from October to May with a greater liveableness of homes. Once these advantages are thoroughly appreciated, this business is bound to have a steady growth.

"A tremendous growth of the industry is inevitable and we have got to make plans for an industry three times its present size. We must make gas quicker and make it in larger quantities. We must have the full co-operation of the regulatory bodies and we must adjust rates so that the cost of service will be equitably proportioned among all classes of customers."

Thursday Session

The sessions Thursday were devoted largely to the reading and discussion of a paper by Glenn C. Carnahan, manager of the House and Water Heating Department of the Peoples Gas Light & Coke Company of Chicago, on "Progress of House Heating by Gas in Chicago."

Dr. Shannon Discusses Safety Work

A plea for wider dissemination of knowledge of proper first aid methods, with special reference to resuscitation from electric shock and gas asphyxia, was made by Dr. E. R. Shannon, of Waterloo, speaking at the Iowa District Gas Association convention.

"Through construction co-operation between the National Electric Light Association, the American Gas Association and the American Medical Association, certain methods of first aid work in these cases have been proven and accepted," Dr. Shannon said. "There now remains the task of educating those in whose hands will most likely fall the opportunity to practice the methods and upon whose knowledge of the technique will depend, perhaps, the life of the victim."

Entertainment Features

The gas men relaxed Thursday evening, being guests at a banquet, after which there was a program of entertaining talks and stunts, principal among which was a night police court scene featuring foibles and misfortunes of visiting gas men.

At the Friday session, C. A. Nash of Davenport, sales manager of the United Light & Power Company, discussed the benefits of newspaper advertising.

H. R. Stephenson, sales manager of the Sioux City Gas & Electric Company, spoke briefly on merchandising.

The convention closed with an open forum, during which questions written out and submitted during the convention were discussed.

Stacey Mfg. Co. Holds Annual Meeting

The annual meeting of the stockholders of the Stacey Manufacturing Company was held at the general offices of the company at Cincinnati, Ohio, on Monday, April 13, resulting in the re-election of J. Frank Stacey, president and general manager; Thomas C. Ranshaw, vice-president, and Edward J. Baechle, secretary and treasurer. George H. Cressler will continue in the capacity of general sales manager for the company.

E. R. Acker Receives Testimonial

E. R. Acker, until lately general superintendent of the Kingston Gas & Electric Company, was recently waited upon by a deputation from the employees and presented with a testimonial in the form of a beautifully engraved and illustrated address as a mark of their esteem for his many high qualities.

The testimonial also included a smoker's cabinet of mahogany, suitably inscribed.

Mr. Acker has been transferred to the headquarters of the Central Hudson System of Gas and Electric Companies as assistant general commercial manager.

A. G. A. Announces Rules and Regulations of 7th Annual Exhibition

The American Gas Association has just issued a bulletin describing the rules and regulations governing the Seventh Annual Exhibition, to be held at Atlantic City from October 12 to 16 inclusive. These rules cover all the various details on renting space and arrangements of exhibits, etc., which are of interest to exhibitors and also contains a plan of the Steel Pier, showing the arrangement of the booths.

Attention is called here to the fact that last year the exhibit was a very successful undertaking and it is expected that this year it will even be more comprehensive and better in various respects than last year.